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Are maps different? Why we do not effectively communicate uncertainty in geographical space.

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There can be considerable amount of uncertainty in geographical (mapped) data. This may be related to the quality and quantity of the underlying data, spatial models or manipulations (e.g. scaling), which have been used to derive the mapped data from the observed data. Whereas significant effort has been made in quantifying the spatial uncertainty, it is still not clear how we communicate this uncertainty both to the scientific, practitioner and general public. Moreover, as maps are often representations of spatial data, and produced with a specific purpose or intent (e.g. soil or geological maps) and there are different consequences to spatial uncertainty under different circumstances, depending on the use of the spatial product. The most effective way to represent this uncertainty therefore depends as much on the type of uncertainty as it does on the manner in which the uncertainty is quantified. Here we explore various ways of determining and representing this uncertainty in spatial data based on a large-scale soil survey project for the Republic of Ireland, in which only 44 % of the country was ever mapped in detail. A field and predictive mapping process was designed for the remaining 66 % of the country at a scale of 1:250,000, in order to fulfil national and European policy requirements. The project combined traditional soil surveying with spatial modelling techniques (digital soil mapping). Empirical data was collected in to the form of 232 soil pits and over 10,000 auger points. Spatial data has therefore been generated in form of modelled soil characteristics, and uncertainty estimated from the surveyed data. We determined both the overall map quality by various model performance and behaviour statistics, and local uncertainty through various forms of 'hot spot' analysis. We also represented the uncertainty in a set of causal models, in which we described uncertainty in terms of how well the mathematical models corresponded to the underlying soil landscape relationships. We found that no singular method effectively describes or communicates uncertainty in these maps and present a method that combines the various forms of uncertainty as possibly the best representation of uncertainty for the map users. It is as yet unclear though whether this method, or the more basic underlying measures, or any uncertainty consideration at all, will be considered by the soil map users.